Knittel, Janette

From: Thomas, Lee
Sent: Tuesday, May 26, 2020 9:39 AM
To: Knittel, Janette; King, Aaron S CIV USARMY CENWK (USA)
Subject: Draft Rhone Poulenc Carbon Dioxide Neutralization Pilot Study Comments
Attachments: Lee Thomas.vcf; Carbon Dioxide Neutralization Pilot Study Comments.docx

Janette,

As requested, I have reviewed the Rhone Poulenc Carbon Dioxide Neutralization Pilot Study and have comments which are attached in a Word document.

Please let me know if you have any questions.

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A review has been conducted of Carbon Dioxide Neutralization Pilot Study Results, Former Rhone-Poulenc Site, Tukwila, Washington, May 15, 2020 as requested. In general, the study has successfully demonstrated that the injection of CO2 may lower the pH in a portion of the high pH area of the site. However, some questions remain to be answered.

General Comments

The criteria that has been used for CO2 neutralization is to reduce the pH to below 8.5 standard units. The basis for the selection of the 8.5 benchmark is the upper limit of the Washington Aquatic Life Criteria for pH (WAC 173-201A-200 and WAC 173-201A-210). However, the numeric criteria sited is only part of the standard. The remaining part of the standard limits the human caused variation to less than 0.2 units for char and less than 0.5 units for salmonid habitat. The report should explain how the Washington Aquatic Life Criteria includes the limits for human caused variation of pH apply to this test.

Bench and pilot scale testing of soils was conducted prior to the CO2 injection which concluded that the soils where testing occurred have little buffering capacity. However, the soils in the test area may not always be typical of soils found in other areas of the site. Within the barrier wall much of the soil is artificial and may be highly variable. Part of the area with elevated pH is located outside the barrier wall and is interconnected with brackish water in the Duwamish Waterway and Slip No. 6. The soils outside the barrier wall may be substantially different than soils inside the barrier wall. It would be helpful if there is any information about soil variability that would shed light about what extent can the conclusions from the bench and pilot scale testing be extrapolated to other areas within the barrier wall. Outside the barrier wall, are the differences so great that a new pilot test in that area would be required?

One of the objectives of this study (#3) was to estimate a practical radius of influence for the CO2 injection wells. In Section 4.3.2, there is a discussion of each phase of injection and the radius of influence and a final estimate of in Section 4.3.3 of a practical radius of influence of being between 10 and 20 feet. However, there is additional information which could be included in the analysis which may provide important information about the practical radius of influence. One example is the influence of different lithologies. Several wells are completed into silty sand (MW-B1-D, MW-A2-D, MW A1-D). Others are completed into sand (MW-B2-S, MW-B1-S, MW-53, MW A2-S, MW-B2-S). A comparative analysis between the two groups of wells could help illuminate if the radius of influence differs depending on lithological differences. Also, there may be distortions from the ideal equal radius of influence in all directions because of anisotropy of the formation material. The groundwater mound distribution may be helpful in estimating the impacts of anisotropy. For example, on Figure 26 the three foot contour is at a greater distance from the injection well to the northwest than to the north east. Although the actual CO2 front may not exactly duplicate the groundwater mound, it may have a similar configuration. The result of additional analysis will likely not be a cylinder. However, the refinement may be useful in helping determine more accurate injection well spacings for the CMS.

In Figure 10, the modeled relationship between Total Acidity Added and pH and the injection well titration show significant differences. At less than pH 7 the two curves show the same trend but are not closely matched. However, above pH 7, the two curves have two completely different trend. If the model curve more closely matched the titration, it would give more confidence to the conclusions. If possible, the model should more closely match the titration. If this could be done, it will help to add confidence to the conclusions as the model assumptions will be known.

Specific Comments

In the cross sections in Figure 5, the areas where caustic conditions exist due to high pH should be shown with shading similar to Figure 3. Addition of this shading would help in the understanding of the setting of the pilot study.

In Figures 17, 18, 19 and 20, well MW-54 has only a portion of the well above the well screen which is included in the shading scheme. The other wells have the entire portion of the well screen included in the shading scheme. Is there some reason that MW-54 is treated differently than the other wells?

In Figures 17, 18, 19 and 20, well MW-B1-S shows a change in TIC or pH as indicated by a color change and before it is within the radius of influence. The change in TIC or pH in MW-B1-S occurs before changes in MW-B1-D which is on the same level as the injection well. Explain what this change signifies.

The labels on the y-axis Figure 31 do not make sense. The y-axis is labeled Changes in Water Level (feet) but the bottom five labels are all 2 feet. Going to the top of the graph, the next labels are all labeled as 3 feet. Finally, the highest bar is labeled as 4 feet. Should the bars be labeled from bottom to top as 2, 3, 4, 5, 6, 7, 8 etc. feet?

In Note Number 3 on Figure 44, it is stated that the "Utilization efficiencies are shown in parenthesis above the bar for each injection." However, although there are numbers above each bar, they are not in parenthesis.

In Figure 45 and 45, in Note # 1, it is stated that if the dissolved concentration exceeded the total concentration, only the dissolved value was presented. However, the dissolved concentration should never exceed the total concentration. It would be better to go ahead and show which samples have dissolved concentrations greater than total concentrations. Some explanation should be provided for the discrepancy. If this situation exists for many or most metals, it may cast doubt on the results and conclusions drawn.